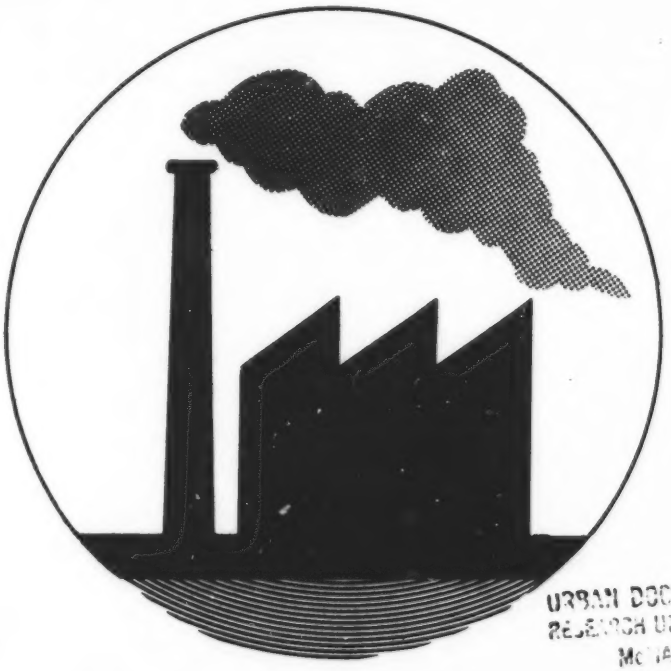
006271

Municipal Environmental Planning Series

# Air Pollution Considerations for Municipal Planning



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MCMASTER UNIVERSITY
HAMILTON, ONTARIO

....An Advisory Publication

Ontario
Ministry of the Environment
Hon. Andrew S. Brandt
Minister
Brock A. Smith
Deputy Minister

June, 1984

# 1. INTRODUCTION

Air is the least visible of our environmental resources, but an essential resource for survival. Certain local uses and characteristics of our air environment require careful consideration in municipal planning, to avoid adversely affecting the quality of our day-to-day activities. This publication provides some basic information on the relationship between land use planning and air pollution from a municipal planning point of view.

Basic planning principles, considerations and questions, are presented to assist in identifying potential air pollution problems, and in determining the information required for the preparation or review of development proposals. The intent is to help reduce air pollution effects on sensitive land uses through municipal planning.

The complex subject of acid rain is beyond the scope of this publication and is still under study. Also, the use of buffer areas to separate incompatible land uses, for the purpose of minimizing the influence of annoying, hard-to-control emissions from pollution sources, will be discussed in an upcoming publication in this series.

The information provided in this paper will help municipal planners, planning consultants and others in their consultations with the Ministry of the Environment (MOE), where air quality may be an issue.

For additional information and a better understanding of the subject, consult the following documents:

- Ministry FACTS sheets on
  - "An Introduction to Air Pollution in Ontario",
  - "About Air Pollution Odours",
  - "About Ontario's Air Pollution Index";
- The Environmental Protection Act (EPA), Regulations 296 and 308; and,
- Agricultural Code of Practice.

These may be obtained from the Ontario Government Bookstore, 880 Bay Street, Toronto, Ontario, M7A 1N8.

# 2. AIR POLLUTION AND AIR QUALITY

## 2.1 General Considerations

*Air pollution* is the presence in the atmosphere of contaminants in quantities sufficient to cause adverse effects on humans, animals, vegetation or property. MOE is primarily concerned with *outdoor* air pollution.

*Air quality* is the degree of excellence of the ambient or surrounding air.

Natural air pollution can occur from phenomena such as earthquakes, volcanic action, and forest fires. In Ontario and as far as this paper is concerned, we are primarily dealing with air pollution resulting from human activities.

Air pollution can result from industrial processes, thermal generating plants, institutional or residential heating plants, restaurant kitchen exhausts, automobile operation, and other operations with air emissions. When a contaminant is produced and emitted into the atmosphere, the occurence of an adverse effect on someone or something usually depends on the concentration and the time of exposure at a receptor.

A number of factors are involved:

- the nature and amount of contaminant emitted;
- where emissions occur in relation to receptors (people, animals, vegetation, property); and,
- how well the emission disperses or is diluted in the atmosphere before it can contact or impinge upon a receptor.

The degree of dispersion in relation to receptors depends on:

- the topography of the area and the height above ground and surrounding buildings of the point of emission, i.e., top of chimney or vent;
- the temperature at the point of emission of the air or gas stream containing the contaminant;
- the exit velocity of the emission; and,
- the meteorological conditions, such as wind speed, atmospheric stability and turbulence.

To ensure that new sources of air pollution comply with Regulation 308, which applies to emissions, MOE examines the plans and specifications of a new source in detail before construction. A Certificate of Approval is issued for proposed pollution control devices, only if the emissions will comply with Regulation 308.

The Ministry's Abatement Program looks after existing sources with the objective of correcting pollution or air quality problems.

When the Ministry issues a Certificate of Approval and considers that a controlled emission source is in compliance, this does *not* mean that the source will never cause air pollution. Equipment breakdowns and malfunctions, human errors, unusual meteorological conditions and combinations of these are facts of life. When they do occur, air pollution may result.

It may be technically possible to control any emission source to such an extent that air pollution incidents will be very rare or non-existent, but this is not always practicable from an economic point of view. The cost of pollution control is seldom, if ever, borne entirely by the owners of the sources. All or part of this cost is passed on to society as a whole, or at least to those segments which

use the goods or services of the sources. Sometimes government grants, subsidies or tax rebates may be involved, which, of course, come from the tax-payer.

Therefore, to ensure freedom from pollution and a satisfactory air quality, it is not always in the public interest to rely solely on pollution controls, applied to the sources of emission, through the Ministry's Certificate of Approval and Abatement Programs. Furthermore, to abate an emission source which is not in compliance may take considerable time, during which people may be exposed to an undesirable air environment. It is important then to consider the spatial relationships between sources and receptors in land use planning, to minimize the adverse effects of air pollution and poor air quality. The up-coming series topic, dealing with environmental compatibility of land uses, will further discuss ways to minimize the adverse influence of certain hard-to-control emissions of annoyance to residents and others.

In summary, municipal planning can minimize air pollution effects on sensitive receptors, and should be considered an important supplement to the control and abatement of air emissions at the source.

## 2.2 Ambient Air Quality Criteria

The criteria given in Ontario Regulation 296 are for desirable ambient air quality. They are based on known effects of contaminants on human health, animals, vegetation, property and aesthetics, e.g., odour, soiling. They are established prior to setting the air pollution standards. They are used for measuring the quality or degree of excellence of the ambient air and for assessing air management and air pollution abatement strategies and programs. Compliance with them is not mandatory. Figure 1 illustrates the format used and some of the contaminants listed in Regulation 296.

## 2.3 Air Pollution Standards

In Ontario, sources of contaminant emissions to the atmosphere are controlled by air pollution standards, expressed as "point of impingement" concentrations in Regulation 308 of the Environmental Protection Act. They are derived from ambient air quality criteria and are set at such values as should ensure that the criteria are met. Point of impingement is a place or area which receives or is contacted by the air containing the contaminant, i.e., the place or structure which intercepts the plume from a stack, chimney or vent.

*Plume interception* is just a special case of a contaminant contacting or impinging on a receptor. This usually occurs when the emissions from the stack, chimney or vent contact a receptor at some elevation above ground level. The situation that often causes concern in municipal planning is the introduction of new high-rise buildings that can interrupt a plume.

Site planning may, in some cases, be used to minimize the effects of plume interception, by ensuring optimal building location and orientation and the location of air intakes, balconies and windows.

Plume interception may occur at considerable distances from large sources such as, thermal generating stations, oil refineries or large smelters. Location of sources in industrial parks or in areas apparently well separated from receptors, is *not* by itself assurance that there will be no problem with plume interception.

Figure 2 illustrates points of impingement and the interception of a plume of emission.

**Figure 1:**
**Some Ambient Air Quality Criteria**
(Excerpt from Ontario Regulation 296, EPA)

| ITEM | NAME OF CONTAMINANT | UNIT OF MEASUREMENT | AVERAGE AMOUNT OF CONCENTRATION OR TOTAL AMOUNT OF CONTAMINANT | PERIOD OF TIME | APPROXIMATE EQUIVALENT AT 10°C AND 760 MM HG PRESSURE |
|---|---|---|---|---|---|
| 3. | Carbon Monoxide | Parts of carbon monoxide per one million parts of air by volume | 30<br>13 | 1 hour<br>8 hours | 36,200 ug/m³<br>15,700 ug/m³ |
| 4. | Dustfall | Tons of dustfall per square mile per month | 20 Total<br>13 | 30 days<br>1 year | |
| 5. | Fluorides (Gaseous) April 15 to October 15 | Parts of fluorides per billion parts of air by volume (Expressed as HF) | 1.0<br>0.4 | 24 hours<br>30 days | 0.68 ug/m³<br>0.34 ug/m³ |



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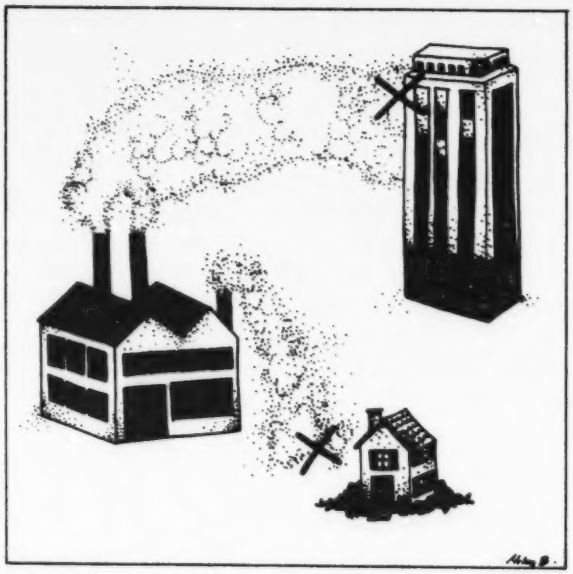
**Figure 2:**
**Points of Impingement and Plume Interception**



The air pollution standards apply across Ontario and are common to all sources of the same contaminants. Figure 3 illustrates the variety of contaminants included in Regulation 308 and the format used.

Compliance with the standards is obligatory for owners and operators of emission sources. The point of impingement concentration for any given source is a calculated value. The method of calculation is given in Regulation 308. The point of impingement, which is used in a calculation to assess the compliance of an emission source, must have some significance, i.e., there must be somebody or something there that can be adversely affected.

The concentration at a point of impingement, of the particular contaminant in question, can be calculated and compared with the relevant standard in Schedule 1, Regulation 308, in order to assess compliance.

The calculation must be performed for each specific situation considering the rate, height and velocity of the emission, the location of the point of impingement, the influence of the wind and other factors.

Use of point impingement standards results in an individual permissible rate of emission for each source, which takes into account local land use, topography, meteorological conditions and spatial relationships between the points of emission and the receptor location.

Use of these air pollution standards means that should the land use in the area affected by a source of emission change, the point of impingement used to assess compliance may change. If this change occurs, then a source which had been in compliance before the land use change, may not comply after the change. The interception of the plume from a stack by newly constructed buildings is shown in the example, Figure 2.

Point sources, i.e., those where the emissions are from a single vent or stack, are usually easier (not necessarily less costly) to control effectively than are area sources, such as, large coal piles, mine and mill tailing dumps, fallow agricultural fields, animal feed lots and industrial areas. Therefore, when area sources are encountered, special care may be necessary to avoid problems.

**Figure 3:**
**Some Point of Impingement Concentrations**
(Excerpt from Schedule 1, Regulation 308, EPA)

| ITEM | NAME OF CONTAMINANT | UNIT OF CONCENTRATION | CONCENTRATION AT POINT OF IMPINGEMENT—HALF HOUR AVERAGE |
|---|---|---|---|
| 49. | Hydrogen Chloride | Micrograms of hydrogen chloride per cubic metre | 100 |
| 50. | Hydrogen Cyanide | Micrograms of hydrogen cyanide per cubic metre of air | 1,150 |
| 51. | Hydrogen Sulphide | Micrograms of hydrogen sulphide per cubic metre of air | 30 |

# 3. PREPARATION AND REVIEW OF PLANS AND PLANNING PROPOSALS

## 3.1 General Principles and Considerations

Good quality air and freedom from air pollution incidents are desirable in all areas. The relevant environmental legislation, criteria and standards apply equally to all parts of the Province and do not depend on the particular zoning or land use. However, the main objective of those involved in preparing, reviewing or approving land use and development plans should be the protection of residential areas and other uses of similar sensitivity, such as the sites of hospitals, nursing homes and homes for the aged, from situations of undesirable air quality.

In the preparation, review and approval of all types of municipal planning documents, whatever is being considered should be looked at from two aspects:

- the *effect* that the *proposal will have* on existing and permitted future uses and on the present and predicted air quality; and,
- the *effect* that existing and permitted future sources and existing and predicted air quality will have *on the proposal*.

In many cases, a cursory examination of the situation will indicate that there should be no problems, e.g., a residential subdivision in an area where air quality is known to be acceptable and there are no sources, including agricultural and livestock operations, in the neighbourhood, that could conflict.

In some other cases, such as the proposed location of residences close to industries, or the establishment of an industrial park, a more detailed examination may be required. Early consultation with MOE is advisable.

Other general considerations are listed below:

- Major pollution sources and numerous small sources should not be introduced into areas where they may adversely affect residential and sensitive land uses.
- The effects of combinations of air emissions may have to be considered.
- Sensitive land uses should not be introduced into areas of poor ambient air quality.
- Large emission sources or many small sources should be located in areas where the ventilation and dispersion characteristics are good.
- The limited capability of the atmosphere to absorb contaminants should be taken into account, when new major or multiple small sources are being considered.
- No additional land uses with hard to control emissions should be permitted near to sensitive land uses, or in areas used to separate conflicting land uses.
- Conflicting land uses should be adequately separated.
- Where development is taking place in, or encroaching upon agricultural areas, conflicts may arise and should be taken into account.
- Concerns regarding air quality and points of impingement problems should be identified and addressed in the planning process as soon as possible, such as at the background study stage.
- It is MOE practice that when a source has satisfactorily completed an abatement program, the creation of a situation by the action of others that would require still further abatement should be avoided, where feasible, in order to avoid imposing unreasonable additional costs on the source's owners. Also, further abatement may not be practicable. This practice is used with discretion, taking into account the local circumstances.

In preparing or reviewing a plan or development proposal, it may be helpful to determine answers to the following questions:

1. What is the air quality in the area(s) under consideration and what is its effect on the use(s) proposed?
2. What effect would the proposed land use(s) have on air quality?
3. Will the proposed land use(s) intercept the existing plumes?
4. Will the proposed land use(s) have to take extraordinary measures to meet point of impingement standards?
5. What is the emission history of existing sources in the area?
6. Is there adequate separation to minimize adverse effects between conflicting land uses?
7. Where existing sources are not in compliance, are they on abatement programs or are other abatement actions pending?
8. Are there any commercial operations, such as restaurants, to be considered?
9. Are there any animal husbandry or other agricultural operations to be considered?
10. If the proposed use(s) will cause problems, what changes or steps are necessary to mitigate adverse conditions?
11. What changes or conditions of approval for the planning document may be necessary to avoid environmental problems?

The Ministry of the Environment will provide advice and information, where available, on such matters as, air quality, compliance of sources, general history of complaints, locations of sources, and potential problems.

### 3.2 Official Plans and Amendments

Serious air quality or point of impingement problems should be dealt with early in the planning process. It is preferable that they be dealt with at the official plan or amendment stage, not at the subdivision stage.

The things that MOE looks for when reviewing an official plan or amendment are:

1. Will any of the policies or designations in the text or maps result in incompatible land uses encroaching upon one another?
2. Are the policies adequate? That is, will they do what they suggest they will do?
3. Does the official plan or amendment contain all the policies that are appropriate for the area and the conditions prevailing, i.e., are there policies to prevent problems that may occur in the area?
4. Will there be a decrease in ambient air quality below that considered acceptable?
5. Will new or different receptors be introduced into areas, creating new or more sensitive or more restrictive points of impingement?
6. Are the designations of specific areas appropriate for the air quality in them?

### 3.3 Zoning By-Laws

Air quality or point of impingement problems should be dealt with before the by-law stage. However, specific concerns may have to be addressed at the by-law stage. These concerns may include the uses to be permitted in an industrial zoning by-law, which may allow certain industries closer to a residential area. Also, rezoning of low density residential areas to permit higher densities, i.e., high rises, may result in impingement problems. MOE will review such by-laws, where appropriate, in a manner similar to official plans and amendments.

When other appropriate measures are not available, site plan control, under section 40 of the Planning Act, may be used to separate emission sources and receptors. MOE should be consulted at an early stage.

### 3.4 Plans of Subdivision

Residential subdivisions are not likely to have any significant adverse effect on the air quality of an area, nor are their emissions likely to cause impingement problems. The things to look for are:

1. Is the existing and predicted air quality satisfactory for residences and if not, in what way and by how much are the criteria exceeded?
2. Are there any existing or future sources whose emissions will impinge on proposed residences in concentrations greater than those permitted by regulation and if so, what can be done?

In industrial subdivisions, the Certificate of Approval process should prevent air quality and impingement problems with new sources. However, consideration of these two matters should be included in the planning or the review of the industrial subdivisions. Unforeseen, hard-to-control emissions may still occur and in areas where the existing air quality is already unsatisfactory or marginal, new sources of the same contaminant may add significantly to the loading of the ambient air.

The things to look for are summarized below:

1. Is the existing and predicted air quality satisfactory for people and structures in the area?
2. Are there any existing sources whose emissions will result in excessive point of impingement concentrations on the new uses of the area, and if so, what can be done about it?
3. Will the new sources, which locate in the industrial subdivision, have any significant adverse effect on the ambient air quality?
4. Will it be difficult for new sources to avoid impingement problems on existing or future receptors because of topography, proximity or other reasons?

### 3.5 Consents

Consents should be treated similarly to plans of subdivision, bearing in mind that usually only one or two lots are involved. Each case should be dealt with on its own merits. Where livestock is concerned, whether on the property from which the lot is to be severed, or on neighbouring property, the Agricultural Code of Practice should be used.

### 3.6 Urban Re-development

Since urban re-development proposals and plans may have attributes about them similar to official plan amendments, zoning by-laws and plans of subdivision, and may actually involve one or more of these planning instruments, they should be treated accordingly.

Usually urban re-development takes place in the older part of cities where the air quality may not meet certain air quality criteria. When this is the case, for reasons of economy and practicality, a recommendation against re-development is not always appropriate. It depends on the nature of the contaminants and on the degree by which the criteria are exceeded. If adverse health effects are unlikely, excessive dust and/or odour incidents are relatively rare, and if criteria are only exceeded by relatively small amounts, MOE may only require that the approving authority and municipality are aware of the drawbacks and constraints. Also, MOE may recommend whatever conditions are considered necessary and leave the decision to the approving authority and municipality.

## 4. CONSULTATION WITH MOE

Early consultation with the Ministry is advisable whenever information is required and potential problems or conflicts are suspected; particularly when new high-rise buildings are likely to result in urban areas.

Early consultation is desirable, since it enables the Ministry to get the information required, if it is not immediately available, and to avoid adversary positions being taken by the various parties before all the facts are known.

In summary, adverse air pollution effects can be minimized for sensitive land uses by having regard to the basic environmental planning principles and considerations outlined, in consultation with MOE.

# MOE REGIONAL AND DISTRICT OFFICES

In the following regions, official plans and subdivisions are handled entirely at the MOE regional level: Central, Northwestern, and Southeastern Regions. In Southwestern, West-Central and Northeastern Regions, the functions are split up so that the Regional Office deals with all official plans and amendments and the relevant District Office handles the plans of subdivision.

This series is prepared by the Land Use Unit, Operational Services Section, Environmental Approvals and Project Engineering Branch, Toronto (416-965-6963).

**Northwestern Region,**
P.O. Box 5000,
435 James Street South,
Thunder Bay, Ontario P7C 5G6
(807) 475-1215

Thunder Bay District Office
(705) 475-1305

Kenora District Office
(807) 468-5578

**Northeastern Region,**
11th Floor, 199 Larch Street,
Sudbury, Ontario P3E 5P9
(705) 675-4501

Sudbury District Office
(705) 675-4501

Timmins District Office
(705) 264-9474

Sault Ste. Marie District Office
(705) 949-4640

North Bay District Office
(705) 476-1001

**Southwestern Region,**
985 Adelaide Street South,
London, Ontario N6E 1V3
(519) 681-3600

London District Office
(519) 681-3600

Owen Sound District Office
(519) 371-2901

Sarnia District Office
(519) 336-4030

Windsor District Office
(519) 254-5129

**West-Central Region,**
P.O. Box 2112, 12th Floor,
119 King Street West,
Hamilton, Ontario L8N 3Z9
(416) 521-7640

Hamilton District Office
(416) 521-7640

Cambridge District Office
(519) 623-2080

Welland District Office
(416) 735-0431

**Central Region,**
Suite 700,
150 Ferrand Drive,
Don Mills, Ontario M3C 3C3
(416) 424-3000

Toronto District Office
(416) 424-3000

York Durham District Office
(416) 424-3000

Halton-Peel District Office
(416) 844-5747

Barrie District Office
(705) 726-1730

Peterborough District Office
(705) 743-2972

Muskoka Haliburton District Office
(705) 687-3408

**Southeastern Region,**
133 Dalton Street,
P.O. Box 820,
Kingston, Ontario K7L 4X6
(613) 549-4000

Kingston District Office
(613) 549-4000

Belleville District Office
(613) 962-9208

Cornwall District Office
(613) 933-7402

Ottawa District Office
(613) 521-3450

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